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A Comparative Study: Dexmedetomidine (5 micrograms) as an Adjuvantto Intrathecal Bupivacaine in Infra-Umbilical Surgical Procedures

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Introduction

The study aimed to evaluate the safety and effectiveness of a spinal anesthetic drug, hyperbaric bupivacaine 0.5%, when paired with 5 µg dexmedetomidine during infra-umbilical operations. Several characteristics were thoroughly evaluated, including changes in hemodynamic parameters, the need for rescue analgesia, and the onset and duration of sensory and motor blockage.

Methods:

The research included 110 ASA I and II patients (aged 18-50) undergoing elective infra-umbilical surgery at a tertiary care institution. Each participant was randomly allocated to one of two groups: Group I got bupivacaine alone, while Group II received bupivacaine with dexmedetomidine. For spinal anesthesia, Group I received 15 mg of 0.5% hyperbaric bupivacaine, whereas Group II received the same dose plus 5 µg of dexmedetomidine. All the characteristics, including the length and onset of the blockage, hemodynamic parameters, and the need for rescue analgesia.

Results:

The baseline parameters were similar. The onset of sensory/motor blockage did not vary considerably. Group II had considerably longer sensory (238.09±47.77 minutes) and motor blockage (220.35±38.07 minutes) than Group I. In Group II, rescue analgesia time was delayed by 279±54.58 minutes. There were no significant variations in heart rate, systolic/diastolic blood pressure. There was no postoperative nausea or vomiting.

Conclusion:

Combining 0.5% hyperbaric bupivacaine with 5 µg dexmedetomidine may extend sensory and motor blockage, postpone the need for rescue analgesia, and maintain hemodynamic stability without

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increasing adverse effects. These data suggest that analgesia's quality has improved. To verify these findings, further multicenter studies with larger sample numbers are required.

Introduction

August Bier performed the first spinal anesthetic on August 16, 1898, at the Royal Surgical Hospital, ushering in a major improvement in pain management. This method entailed administering cocaine straight into the spinal canal. [1,2] This groundbreaking treatment was a watershed moment since the patient felt no discomfort throughout the operation [3-5]. Spinal anesthesia, which is simple and effective, has become the primary approach for lower abdominal and lower limb procedures. It tackles the problems of General Anesthesia (GA), such as respiratory and cardiovascular issues, by providing quick drug onset, shorter incision time, and improved postoperative care [6, 7]. Despite its benefits, Spinal Anesthesia has drawbacks, including inadequate pain reduction in some procedures and symptoms such as backache and post-dural puncture headache [8-10]. To overcome these limitations, many adjuncts, such as Fentanyl, Butyrphanol, Clonidine, and Dexmedetomidine, have been developed. Dexmedetomidine, an Alpha 2 receptor agonist, has gained popularity for its ability to lengthen the duration of spinal blocks while having minimal adverse effects [11, 12]. This research looks at the safety and efficacy of using 0.5% hyperbaric bupivacaine and dexmedetomidine in combination with plain bupivacaine to provide spinal anesthetic for operations done below the umbilicus. The primary aims of the research are to assess changes in hemodynamic parameters, the initiation and progression of sensory and motor obstruction, and the need for further analgesics. The use of adjuvants in spinal anesthesia, particularly dexmedetomidine, is a viable route for improving the method and resolving its shortcomings. [13, 14] This study adds to our understanding of spinal anesthesia adjuvants, which may have implications for improving patient outcomes in surgical procedures.

Materials & Methods

The research was carried out in a Tertiary Care Centre in Odisha, with 110 patients scheduled for infraumbilical procedures. Participants were randomly allocated to either Group I (simple 0.5% hyperbaric Bupivacaine) or Group II (0.5% hyperbaric Bupivacaine plus Dexmedetomidine), based on ASA I and II criteria, respectively. Informed consent, clear explanations, and complete clinical evaluations were performed. Patients were given Ringer's lactate prior to anesthesia, and their vital signs were monitored during the surgery using multipara monitors.

Participant size- was of the total of 110 Patients,with two groups (I and II) of 55 each.

$n = (Z1-\alpha/2 + Z2-)^2 (\sigma s1\ 2 + \sigma s2^2)$

$(\text{Assumed difference})^2$

Where, α error = 1.96, β error = 0.84σs1 = 16.6, σs2 = 11.86.
Assumed difference = 8.

Inclusion Criteria

- ✔ 18 -50 years.
- ✔ Patients belong to ASA I & II Physical Status.
- ✔ All patients are going through elective infra- umbilical surgery.
- ✔ Surgery Duration < 90 minutes.

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Exclusion Criteria

- ✓ Pregnant women undergoing any surgery
- ✓ Patient with a History of allergy to the study drug
- ✓ Patients with coagulation problems andlocalized infections at the site of spinal anesthesia

Data Collection

During the data collecting phase, patients who met ASA I and II requirements for infra-umbilical operations were selected using inclusion-exclusion criteria. A Spinal anesthesia was administered using a Quincke spinal needle (25G) and a 24G hypodermic needle, using medicines such as bupivacaine, dexmedetomidine, ondansetron, and paracetamol. A multiparameter monitor, tuberculin syringe, and a Visual Analog Scale (VAS) chart were used. Spinal anesthesia was delivered aseptically in the L3-L4/L2-L3 subarachnoid area. The patients were randomly assigned to two groups: Group I received hyperbaric Bupivacaine alone, while Group II received hyperbaric Bupivacaine with dexmedetomidine. It was established how long and when sensory and motor blockages occurred, as well as if rescue analgesia was required.

Statistical analysis

Categorical variables were reported as percentages and figures, whereas quantitative data were provided as means±SD, median, and interquartile range (25th and 75th percentiles). Non-parametric tests were used for data that did not fit into a normal distribution, with the Kolmogorov-Smirnov test establishing normality. The Independent t-test was used for variables that did not match the criteria, and the Mann-Whitney Test for the rest. Qualitative factors were evaluated using the Chi-square test. SPSS version 25.0 was used in the research, with data input assisted by Microsoft Excel. The p-value was determined using a significance level of <0.05.

Results

The research was done at a tertiary care center and included 110 ASA-classified patients aged 18 to 50. These people had elective infra-umbilical surgery. Patients were randomly assigned to two groups: Group I (n=55) got Hyperbaric Bupivacaine (0.5%) 15mg with 0.1 ml normal saline, and Group II (n=55) received Hyperbaric Bupivacaine (0.5%) 15mg with five mcg Dexmedetomidine. Figure 1 shows that the age and gender distributions were similar amongst the groups (p values = 0.589 and 0.303, respectively). The mean±SD of age (years) in Group I was 33.36±10.78, whereas in Group II it was 32.49±9.29, with no significant differences (p=0.65).

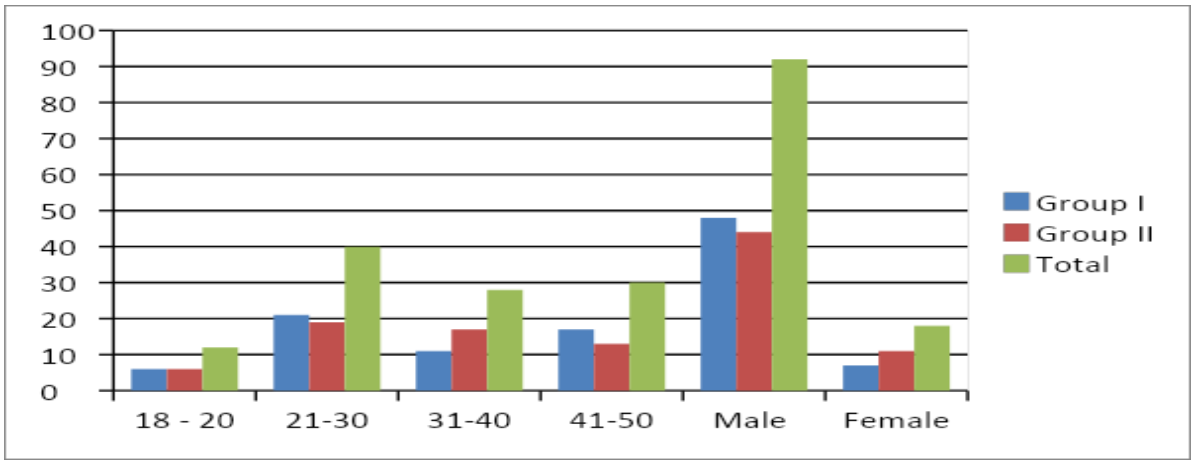

Figure 1: Comparing of Age/ Gender in group I and II

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The distribution of ASA grade was comparable between Group I and II, with 65.45% and 60%, respectively, for Grade I and 34.55% and 40%, for Grade II (p value=0.554), as illustrated in Table 1.

Table 1: Comparison of group I and II's ASA grades.

ASA grade	I	II	Total	P value
I	36 (65.45%)	33 (60%)	69 (62.73%)	
II	19 (34.55%)	22 (40%)	41 (37.27%)	
Total	55	55	110	0.554

No statistically significant difference in heart rate (per minute) was noticed between Group I and Group II at baseline (p value=0.642), as demonstrated in Figure 2. Furthermore, there was not a noticeable distinction in systolic blood pressure (mmHg) at baseline (p value=0.167), as indicated in Table 2.

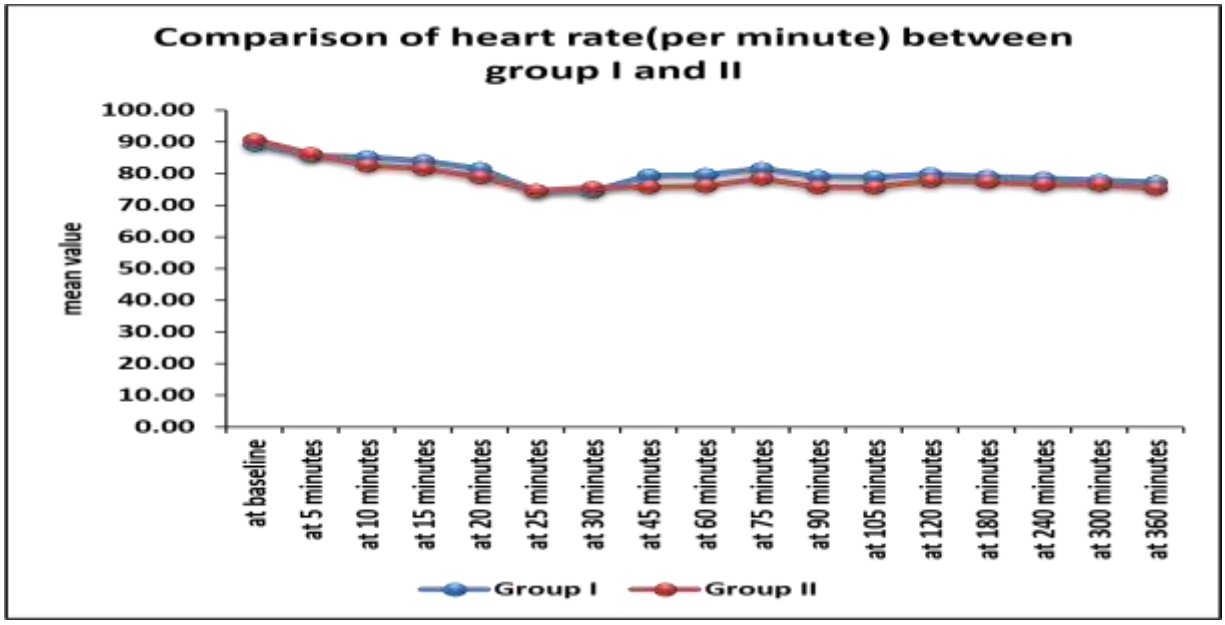

Figure 2: Comparison of trend of heart rate

Table 2: Systolic blood pressure comparison (mmHg) between groups I and II.

Systolic blood pressure (mmHg)	Group I(n=55)	Group II (n=55)	Total	P value
At baseline				
Mean±SD	136.02±12.6	133.02±9.85	134.52±11.36	
Median (25th-75th percentile)	138(132-142)	132(128-140.5)	136(128-142)	0.167†
Range	111-158	109-154	109-158	

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Discussion

There was no discernible difference between Group I and II in the study's assessment of the onset of a sensory block, which was assessed from the intrathecal injection to the loss of pinprick sensation at the T10 dermatome (5.27+/-1.76 minutes) and Group II (5.04+/-1.94 minutes) (p=0.524). This conclusion contradicts the findings of S Patro, H Deshmukh et al. (2016), who found that Dexmedetomidine dramatically hastened the onset of sensory block when compared to normal hyperbaric Bupivacaine [15]. Gupta M. et al. (2014) discovered no noticeable difference in sensory block onset between the Dexmedetomidine and Buprenorphine groups [16]. Furthermore, in our investigation, the beginning of motor block was determined by evaluating the time between the injection and full motor block regression. (Brommage Score of 3) There was no statistically significant difference between Group I (4.28+/-2.11 minutes) and Group II (4.48+/-3.06 minutes) (p=0.682). This study contradicts Patro's (2016) data, which showed a considerably quicker onset with Dexmedetomidine than with regular Bupivacaine [15]. However, Gupta and Shailaja (2014) reported no noticeable difference in motor block onset between the Dexmedetomidine and Buprenorphine groups, which is consistent with our findings [16]. These discrepancies in start dates might be related to changes in research demographics, medication dosages, and particular techniques between studies. When analyzing and comparing research findings, these variables must be taken into account. Mohamed Taznim et al. (2017) investigated Dexmedetomidine and compared different hyperbaric Bupivacaine doses for spinal anesthesia. They combined 5mcg of Dexmedetomidine with dosages of 7mg, 8mg, and 9mg hyperbaric Bupivacaine. The time necessary for analgesia to commence (to reach the T10 sensory level) was longer. In Group A (9.7±1.088 min) compared to Group B (9.59±1.583 min) and C (8.90±1.709 min), despite the fact that there was no statistically significant change (P=0.0831) [17]. The duration of sensory occlusion during the current trial differed statistically significantly between the two groups, as discovered. The duration of the sensory block was measured from the time the sensory level decreased to S1 until the T10 dermatome level was reached. Group I had a sensory blockage for 187.2±36.88 minutes, while Group II experienced it for 238.09±47.77 minutes (P<0.0001). Patro, H. Deshmukh et al. (2016) found that Group II had a sensory block for 317.70±16.16 minutes, whereas Group I had a block for 188±11.86 minutes [15]. Milad Minagar et al. investigated the efficacy of intrathecal bupivacaine and dexmedetomidine for lower abdominal surgery in a 2018 paper. The Bupivacaine group had a shorter average sensory block (230±86 minutes) compared to the Dexmedetomidine + Bupivacaine group (495±138 minutes) (p < 0.000). [18]. Gupta Mahima, S Shailaja, et al. (2014) evaluated intra-thecal Dexmedetomidine and Buprenorphine as adjuvants to Bupivacaine in spinal anesthesia. The Buprenorphine group had sensory blockage for 225±64.94 minutes, whereas the Dexmedetomidine group experienced it for 451.4±270.19 minutes (P=0.002). This implies that Dexmedetomidine significantly increased the duration of sensory block when compared to buprenorphine. [16]. In our study, the length of the motor block was determined by timing the injection and the completion of the whole motor block regression. (Brommage Score: 3). Group I suffered motor blockage for 179.45±43.79 minutes, whereas Group II had it for 220.35±38.07 minutes (P<0.0001). Patro, H Deshmukh et al. (2016) found that motor block lasted 286.33±15.15 minutes in Group II (Dexmedetomidine + Bupivacaine) and 166.5±12.11 minutes in Group I (Bupivacaine) [15]. Gupta and Shailaja (2014) found significant variations in the duration of motor obstruction between the buprenorphine and dexmedetomidine groups. [16]. In terms of postoperative pain, the NRS score was collected 90 minutes after obtaining the T10 sensory level, and rescue analgesia administration duration was considerably delayed in Group II (279±54.58 minutes) compared to Group I (226.35±46.14 minutes, P<0.001) [19-21]. Patro S, H Deshmukh et al. (2016) found that Dexmedetomidine provided analgesia for 333.6±20.67 minutes compared to 193±7.06 minutes in the Bupivacaine group. [22]

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Conclusion

Recent clinical comparative research found that combining 5 μg (0.1 ml) of dexmedetomidine with 0.5% hyperbaric bupivacaine (15 mg or 3 ml) for spinal anesthesia had many benefits. These consist of prolonging the duration of the motor and sensory blockades. In addition, the duration and quality of analgesia were reported to improve. Furthermore, the introduction of Dexmedetomidine improves hemodynamic stability throughout the surgery. However, it is important to emphasize that the study recognizes the need for more research validation. The advice is for a multicentre, larger sample size research. This would assist to validate and reinforce the validity of the existing results.

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